Fermilab

Directorate

MEMORANDUM OF UNDERSTANDING
FOR THE 2002-3 MESON TEST BEAM PROGRAM

T927

BTeV - Pixel Detector Test Beam Run

May 6, 2002

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INTRODUCTION

E918 (BTeV) is an approved experiment. It requires detector research and development in tracking, triggering, data acquisition, charged hadron identification, electromagnetic calorimetry and muon detection, as well as an extensive effort in simulation and software development. The goal of the present R&D project is to develop the final devices for use in the BTeV experiment. This MOU relates to pixel tracking tests that will be carried out using the MTEST beam of the Meson Area during the 2002-2003 run period.

This is a memorandum of understanding between the Fermi National Accelerator Laboratory and those experimenters of E918 who have committed to participate in pixel beam tests to be carried out during the 2002-2003 period. The memorandum is intended solely for the purpose of providing a budget estimate and a work allocation for Fermilab, the funding agencies and the participating institutions. It reflects an arrangement that currently is satisfactory to the parties; however, it is recognized and anticipated that changing circumstances of the evolving research program will necessitate revisions. The parties agree to negotiate amendments to this memorandum that will reflect such required adjustments.

I. PERSONNEL AND INSTITUTIONS

Spokespersons:	J. N. Butler, Fermilab
	Sheldon Stone, Syracuse University
Physicist in Charge:	Charles Newsom, University of Iowa
E918 Computing Off-line liaison:	Rob Kutschke, Fermilab
E918 Computing On-line liaison:	Gabriele Chiodini, Fermilab
Fermilab liaison physicist:	Erik Ramberg
Beamline physicist:	From Beams Div./External Beams Dept.
	Currently, Tom Kobilarcik
Particle Physics Division Liaison:	Erik Ramberg
Computing Division Liaison:	Dave Slimmer

The Collaboration members at present are

1.1 Fermilab: J.A. Appel, C. Brown, J.N. Butler, H. Cheung, G. Chiodini, S. Cihangir, D. Christian, M. Coluccia, L. Garren, E. Gottschalk, R. Kutschke, S. Kwan, M. Votava, M. Wang.

1.2 University of Iowa : C. Newsom

1.3 Syracuse University: M. Artuso, S. Stone, J-C. Wang, C. Boulahouache, R. Radjimi (graduate student).

1.4 University and INFN of Milan: G. Alimonti, S. Magni, D. Menasce, L. Moroni, D. Pedrini, S. Sala, L. Uplegger (RA), P.D'Angelo.

1.5 Wayne State University: D. Cinabro, A. Schriener (RA), S. LaPointe (REU), G. Galay (REU)

1.6 University of Wisconsin: M. Sheaff.

Other commitments:

CLEO: Artuso, Cinabro, Stone, Wang (J.C.).
FNAL E831/FOCUS analysis: Butler, Cheung, Chiodini, Garren, Gottschalk, Kasper, Kutschke, Menasce, Moroni, Pedrini, Sala, Milazzo, D'Angelo, Casimiro, Sheaff, Wang (M.)
FNAL E791 analysis: Appel, Kwan, Sheaff
FNAL E781/SELEX analysis: Newsom
FNAL E690 analysis: Christian

II. EXPERIMENTAL AREA, BEAMS AND SCHEDULE CONSIDERATIONS

2.1 LOCATION AND FACILITIES

2.1.1 The test apparatus is to be located in the upstream clean room (the "Hut" in MT6-A1) in the MTEST beam line. In addition, the test-beam Control/Counting Room to the west of the MTEST beam and the small alcove to the east will be used to house electronics.

2.1.2 A clean assembly area will be needed, equipped with clean and dirty power. An overhead HEPA filter to work under and a microscope for alignment work would be quite useful. Sufficient space for multiple detector groups will be necessary. A "gateway" computer with Internet access should be provided. Powered racks for electronics and NIM bins should also be made generally available.

2.1.3 Space in cable trays for approximately 70 cables (40 with BNC, 25 with SHV, and other misc. termination cables) connecting the Hut to the Alcove and Counting Room are required.

2.1.4 Electronics Racks are needed in the Hut (3), the Counting Room (1), and Alcove (1) are needed.

2.1.5 One standard-size table will be required in the test-beam Counting Room and in the Alcove. Computer networking to the gateway computer will be required at both tables

2.1.6 The power requirements are 2.5 KW of clean power for electronics and an additional 7.5 KW for cooling and other uses.

2.1.7 In addition to the environmental conditioning, special conditions will have to be maintained immediately around the devices under test. This will require the use of dry nitrogen, and for some special running at cryogenic temperatures, liquid nitrogen.

2.1.8 Dry nitrogen gas will be required in the MT6-A1 area for the pixel tracking telescope and devices under test. This may be done by using facilities in the common test- beam gas shed.

2.2 BEAM

2.2.1 The tests will use slow resonantly-extracted, Main Injector proton beam focused onto the MTest target. The tests require a beam of untagged, charged particles of energy 100 GeV/c or higher.

2.2.2 Intensity: Variable, in the range of 10-100 KHz in an area of 1 square cm. With the current beam line design this is expected to require up to 2×10^{11} primary protons per second.

2.2.3 A beam duty factor better or equal to 0.5 during spills is desirable. The 1 second spill per 3-4 seconds and anticipated 30% duty factor is acceptable. A longer spill time is acceptable. It is the total effective spill seconds that is the relevant parameter. The duty factor may be defined by the ratio: (N1*N2)/(N1•N2) divided by 53×10^6, where N1*N2 is the coincidence rate between any two un-correlated counters, and N1•N2 the product of individual counter rates – as will be provided by the Meson Test Beam Facility.

2.2.4 Some operation with 132 ns spaced (every 7 rf buckets) beam is desirable.

2.3 SCHEDULE

The goal is to deliver charged particles at the rate stated above for data taking as required by the R&D program over a significant period beginning as close to the start of the run as possible. The group expects to collect data on several detectors for short bursts of shifts and to repeat some of the tests several times. The total time required is not that large, but flexibility in scheduling is important. The group expects to share beam time with other R&D efforts. Details are given in the section below labeled Run Plan.

III. RESPONSIBILITIES BY COLLABORATING PHYSICS GROUP

([] denotes replacement cost of existing hardware.)

3.1 Fermilab

Fermilab physicists will be responsible for the trigger and for the irradiation of devices under test (e.g., at the Indiana University Cyclotron Facility), and will share responsibilities for the pixel tracking telescope, data acquisition and monitoring, software and web support, and data analysis.

3.1.1	A silicon pixel telescope consisting of 6-8 planes	[$ 80 K]
3.1.2	Pixel devices for test (before and after irradiation)	[100]
3.1.3	Low and high voltage power supplies for pixel devices	[50]
3.1.4	Readout electronics for the above devices	[40]
3.1.5	DA computer	[6]
3.1.6	Chiller to maintain –10 degree pixel operation	[10]
3.1.7	Misc. cables (from previous experiment use)	[4]
3.1.8	Shop time for assembly of pixel telescope and pixel devices under test	2
3.1.9	Misc. expendables and services	8
	Total existing items	**[$290 K]**
	Total new equipment items	**0**
	Total operating cost	**$ 10 K**

3.2 University of Iowa

University of Iowa will provide coordination of test beam activities including gas and power needs, and mechanical and cooling systems for the pixel tests. Collaborators will also work on data acquisition and monitoring, software and web support, and data analysis.

3.2.1 Acopian Power Suppleis (5-7 V)
3.2.2 TC953 High Voltage Power Supplies
3.2.3 1 LeCroy 4032 with CAMAC controller
3.2.4 Pixel telescope mounting structures ("pixel box")
3.2.5 Water/glycol chiller for cooling pixel planes
3.2.6 Offline use of farm CPUs for analysis at Iowa
3.2.7 One full time physicist (CRN) for 7 months at Fermilab
3.2.8 Operating funding ($ 30 K) requested of DOE for travel, etc.

Total existing items	**[$ 55 K]**
Total new equipment items	**$ 0 K**
Total operating cost	**$ 30 K**

3.3 University and INFN of Milan

Milan collaborators will assist in the setup of the pixel tests, and participate directly in the tests. Milan personnel will also provide the DAQ software for the PCI-bus system and share responsibilities for other parts of the DAQ and for the analysis of the data.

3.3.1 Computer and PCI bus extender for DAQ software development in Milan. [$ 10 K]
3.3.2 Support and travel for members to participate in the run and the analysis of the data $40K

Total existing items	**[$ 10 K]**
Total new equipment items	**$0 K**
Total operating cost	**$ 40 K**

3.4 Syracuse University

Syracuse will be responsible to implement and maintain the simulation algorithms and off-line analysis software for the pixel test beam data. Moreover they will participate in data taking. Responsibility will be taken for tests of collection properties of different p-stop implant configurations, including assembly of new, appropriate FPIX0 read-out boards.

3.4.1 Design, assembly and test of FPIX0 printed circuit boards $ 3 K

3.4.2	Design, assembly and test of FPIX0 mezzanine boards	3
3.4.3	Support of group members for tests	10
3.4.4	Additional CPU and disk for analysis	6
3.4.5	Use of existing computer farm for simulation and data analysis	[45]

Total existing items	**[$45 K]**
Total new equipment items	**$ 12 K**
Total operating cost	**$ 10 K**

3.5 Wayne State University

Wayne State will build a cryogenic cooling system including a helium chiller, controller, monitoring electronics, and a liquid nitrogen gravity fed cooling system consisting of a dewar, heat exchanger, plumbing and control system to dissipate 10 Watts of heat (one or two boards) at -100 degrees C. Such a system will cost about $10K that Wayne State will provide from BTeV R&D funds from the NSF. Fermilab will need to provide a helium gas bottle and a couple of gallons of liquid nitrogen. The system has modest power requirements more than covered by the general request. Wayne State would build and test the system in Detroit and bring it down to Fermilab as a turnkey system that can swap in for part of the water-glycol system to cool one or more pixel boards. Some plumbing and attaching of sensors will have to be done at Fermilab, but we do not foresee a significant construction project along the beam line. The plan is to move the system to Fermilab about 1 June (when the REU students start).

Total existing items	**[$ 0 K]**
Total new equipment items	**$ 10 K**
Total operating cost	**$ 10 K**

3.6 University of Wisconsin

University of Wisconsin will participate in the preparation and data taking phases of the pixel tests.

Total existing items	**[$ 0 K]**
Total new equipment items	**$ 0 K**
Total operating cost	**$ 0 K**

3.S Summaries of Section 3

3.S.1 Summary of Collaboration Responsibilities

Test beam coordination (hut, environment, cable tray, racks, crates, and coordination with other groups) – Iowa

Mechanical support and cooling – Iowa and Wayne State

Trigger - Fermilab

Data Acquisition – Fermilab and Milan

Monitoring and Event Display – Fermilab and Milan

Pixel Tracking Telescope (detectors, boards, assembly and testing) – Fermilab and Wayne State

Devices Under Test (detectors, boards, assembly and testing) – Fermilab and Syracuse

Offline Software (including data bases, run log, and web: development, maintenance) – Fermilab, Iowa, Milan, and Syracuse

3.S.2 Summary of Non-Fermilab Costs

	Equipment	Operating
Total existing items	**[$110 K]**	
Total new items	**$ 22 K**	**$ 90 K**

IV. RESPONSIBILITIES BY FERMILAB DIVISION

([] denotes replacement cost of existing hardware.)

4.1 Fermilab Beams Division

4.1.1 Use of MTest beam line.

4.1.2 Maintenance of all existing standard beam-line elements (such as SWICs, loss monitors, remotely-controlled finger counters, etc), instrumentation, controls, clock distribution and power supplies.

4.1.3 Beam controls console and remote data logging capability (ACNET)

4.1.4 Reasonably rapid access to our equipment in the test beam. This will mitigate any interference with experiments running in adjacent beam lines. Such access is anticipated to be less than once per hour, typically more like once per shift.

4.1.5 Logic signal at experimenter electronics racks that has a constant phase (within 1-2 ns in a given hour) with respect to the arrival of beam buckets at the test apparatus.

4.1.6 No experiment-owned devices need interfacing to the Beams Division control system, other than the possible readout of beam-line variables of 4.1.3.

4.1.7 The test-beam energy and the rest of the beam-line elements will be under the control of the Main Control Room

4.1.8 Position and focus of the beam on the experimental devices under test will be under control of the BD Operations Department (MCR). Control of secondary devices that provide these functions may be delegated to the experimenters as long as it does not violate the Shielding Assessment or provide potential for significant equipment damage.

4.1.S Summary of Beams Division costs:

	Equipment	Operating	Personnel (person-weeks)
Total new items	$ 0 K	$ 0 K	0
Total	$ 0 K	$ 0 K	0

4.2 Fermilab Particle Physics Division

The test-beam efforts in this MOU will make use of the Meson Test Beam Facility. Requirements for the beam and user facilities are given in Section 2. The Fermilab Particle Physics Division will be responsible for coordinating overall activities in the MTest beam-line, including use of the user beam-line controls, readout of the beam-line detectors, and MTest gateway computer. In addition, support from the Silicon Detector Facility and the Microdetector Group will be required in preparing the pixel beam-tracking telescope and devices under test. Costs under this section will be funded from BteV R&D accounts.

4.2.1 Tools and supplies for MTest	$ 1.0 K
4.2.2 Four Unistrut stands for trigger counters	1.0
4.2.3 Assistance in constructing 6 trigger counters. Tubes, light guides, and bases will come from existing counters. Existing plastic needs to be cut to the proper dimensions and the counter will need to be glued and wrapped.	2.0
4.2.4 Use of the gateway UNIX computer for interfacing and isolation of DA computers.	
4.2.5 Survey of detectors on beamline (trigger counters, pixel telescope, pixel detector housing).	
4.2.6 Installation and wiring of two relay racks in counting room.	0.4
4.2.7 Cable tray installation as needed	0.4
4.2.8 Installation of gas lines for N2 flushing.	0.4
4.2.9 Installation of quiet power to detector enclosure if required to reduce noise in electronics Provision of adequate air-conditioning and cooling for detectors and electronics in the beam area, the electronics alcove, and the counting room.	
4.2.10 Provision of adequate moisture protection for equipment and personnel in MTest beam area,	

Alcove, and counting room.

4.2.11 Some liquid nitrogen will be required from Fermilab for the Wayne State cryogenic system, as well as some plumbing and attaching of sensors. 2.0

4.2.S Summary of Particle Physics Division costs:

	Equipment	Operating	Personnel (person-weeks)
Total existing items	**$ 0 K**		
Total new items	**$ 7.2 K**	**$ 0 K**	**1**
Totals	**$ 7.2 K**	**$ 0 K**	**1**

4.3 Fermilab Computing Division

4.3.1 The Liaison from the Computing Division is Dave Slimmer.

4.3.2 The attached off-line analysis plan contains the experiment's present understanding of its analysis model from code development, through production, stripping, final data analysis and Monte Carlo. A more detailed quantitative description is given in Appendix II. The Computing Division cannot guarantee, at this time, that these resources can be made available. The Computing Division, guided by priorities set by management, will attempt to allocate on a quarterly basis, the available resources. The present request and amendments will be used in attempting to plan the laboratory's computing acquisition strategies.

4.3.3 Support from the On-line and Database Systems Department and the Electronics Systems Department (ESE) in developing and implementing the DAQ/On-line system for the pixel detector tests. [BTeV has assigned 1 FTE (Lorenzo Uplegger of Milan) to the implementation of the software part of this project.] Some mentoring from a CD computing professional familiar with the system might be necessary. This might involve 10% of an FTE for a short period of time. Some off-hour support may be required for efficient use of beam-time. Details of the support will be worked out among CD, PPD and the experiments.

4.3.4 Computer security for the pixel system in MTest will be organized by having wide-area networking for the DA computers through the Meson Test Facility gateway computer and via kerberized systems more directly attached to the networking backbone.

4.3.5 The ESE department will provide design, layout, assembly, testing, and engineering support for the PCI Test Adapter and Programmable Mezzanine Card for the test beam run. It will also provide design, layout, assembly, testing, and engineering support for the FPIX1 and FPIX2 Inner Cards for readout of the FPIX1 telescope. This includes integrating the telescope into the DAQ system and interfacing the DAQ to the trigger and clock systems.

4.3.6 Support of the networking in MTest, including access to a gateway computer and local networking between the gateway and DA computer(s) which will not have network access. The support level for the gateway computer and support mechanisms are not specified in this MOU. Ethernet access in the test beam area to the Internet backbone will be provided. This may require more than running a cable to an existing bridge.

4.3.7 Maintenance and update services for operating systems and packages to versions & levels supported by the Computing Division. $2.0K

4.3.8 Maintenance and repair of PREP and DA equipment. $5.0K

4.3.S Summary of Computing Division Costs:

Type of Funds	**Equipment**	**Operating**	**Personnel (person-years)**
Total existing items	[$203.5K]		
Total new items	$0.0K	$7.0K	
Totals	**$203.5K**	**$7.0K**	

4.S Summary of Fermilab costs

Type of Funds [] denotes existing	**Equipment**	**Operating**	**Personnel** (person-weeks)
Beams Division	$ 0 K	$ 0 K	0
Particle Physics Division	7.2	0	1
Computing Division	[203.5]	7	0
Totals Fermilab	**$ 210.7 K**	**$ 7 K**	**1**

V. SPECIAL CONSIDERATIONS

5.2 The responsibilities of the Scientific Spokesperson and procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Experimenters" (PFX). The Scientific Spokesperson agrees to those responsibilities and to follow the described procedures.

5.3 To carry out the experiment, a number of Environment, Safety and Health (ES&H) reviews are necessary. The procedures to carry out these various reviews, including a Partial Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee, are found in the Fermilab publication "Review Procedures for Experiments" (RPX). The spokesperson undertakes to follow those procedures in a timely manner.

5.4 For the purpose of estimating budgets, specific products and vendors may be mentioned within this memorandum. At the time of purchasing, the Fermilab procurement policies shall apply. This may result in the purchase of different products and/or from different vendors.

5.5 The experiment spokespersons will undertake to ensure that no PREP and computing equipment be transferred from the experiment to another use except with the approval of and through the mechanism provided by the Computing Division management. They also undertake to ensure that no modifications of PREP equipment take place without the knowledge and consent of the Computing Division management.

5.6 Each institution will be responsible for maintaining and repairing both the electronics and the computing hardware supplied by them for the experiment. Any items for which the experiment requests that Fermilab performs maintenance and repair should appear explicitly in this agreement.

5.7 If the experiment brings to Fermilab on-line data acquisition or data communications equipment to be integrated with Fermilab owned equipment, early consultation with the Computing Division is advised.

5.8 At the completion of the experiment:

5.8.1 The spokesperson is responsible for the return of all PREP equipment, computing equipment and non-PREP data acquisition electronics. If the return is not completed after a period of one year after the end of running the Spokespersons will be required to furnish, in writing, an explanation for any non-return.

5.8.2 The experimenters agree to remove their experimental equipment as the Laboratory requests them to. They agree to remove it expeditiously and in compliance with all ES&H requirements, including those related to transportation. All the expenses and personnel for the removal will be borne by the experimenters.

5.8.3 The experimenters will assist the Fermilab Divisions and Sections with the disposition of any articles left in the offices they occupied, including computer printout and magnetic tapes.

SIGNATURES:

__________________________ 1 / / 2002
Joel Butler, E-918 Spokesperson

__________________________ 1 / / 2002
Sheldon Stone, E-918 Spokesperson

__________________________ 5 /24/ 2002
John Cooper, Particle Physics Division

__________________________ 5 /31/ 2002
John Marriner, Beams Division

__________________________ 5 /29/ 2002
Steve Wolbers, Computing Division

__________________________ 5 /29/ 2002
William Griffing, ES&H Section

__________________________ 6 / 3 /2002
Michael Shaevitz, Associate Director, Fermilab

__________________________ 6 / 3 / 2002
Michael Witherell, Director, Fermilab

APPENDIX I - PREP AND DAQ EQUIPMENT (NOTE: THIS IS A PLACEHOLDER ACTUAL LIST IS BEING PREPARED BY COMPUTING DIVISION)

MISCOMP
PREP POOL EQUIPMENT TOTALS 15-FEB-99

TC PROVCLASS	DESCRIPTION	QREQ	COST	TOTCOST
AA MECHTRON: 3034	BIN,NIM	2	381	762
AB PD: AEC-320-9	POWER SUPPLY,6@10A,12@3A,24@1.5A,	2	621	1242
AD LRS: 621L	DISCRIMINATOR,4CH,NIM	3	706	2118
AE LRS: 365	LOGIC,2CH,4-FOLD,MAJORITY,NIM	6	740	4440
AF PHILLIPS: 744	FAN-IN/OUT,4CH,LINEAR GATE,250MHZ	1	1116	1116
AG LRS: 428	FAN-IN/OUT,4CH,LIN,NIM	1	435	435
AG LRS: 628	FAN-IN/OUT,8CH,NIM	1	1399	1399
AH LRS: 612A	AMPLIFIER,12CH,X10,PHOTOMULT,NIM	1	966	966
AN LRS: 222	GENERATOR,GATE,2CH,NIM	1	1001	1001
AO JORWAY: 1880B	SCALER,2CH,VISUAL,NIM	5	848	4240
AP JORWAY: 1883	SCALER,PRESET,8 DIGIT,100MHZ	1	591	591
AR LRS: 4616	CONVERTER,16CH,ECL/NIM/ECL,NIM	1	1184	1184
AR LRS: 688AL	ADAPTER,LVL,NIM/TTL-TTL/NIM,NIM	1	663	663
AR PHILLIPS: 726	TRANSLATOR,LVL,TTL/NIM/ECL,150MHZ	2	1155	2310
AY LRS: 3001	ANALYZER,QVT,MULTI-CHANNEL,NIM	1	2752	2752
AY LRS: 3157	INTERFACE,DISPLAY,QVT,NIM	1	919	919
EA LRS: 9400A	OSCILLOSCOPE,2CH,175MHZ	2	9000	18000
EA TEK: 2465	OSCILLOSCOPE,4CH,350MHZ	1	5979	5979
FA LAMBDA:	POWER SUPPLY	1	607	607
FB FLUKE: 415B	POWER SUPPLY,HV,3KV@30MA	2	575	1150
FD FERMI: ES-7092V	DIVIDER,HIGH VOLTAGE,VERNIER	1	1128	1128
GA GENRAD: 1340	GENERATOR,PULSE,0.2HZ TO 20MHZ	1	484	484
GA PHILLIPS: 417	GENERATOR,PULSE,POCKET	2	63	126

60 rows selected.

Total Req QTY is XX

Total Cost for Planning Purposes XXXXXXX

APPENDIX II – E918 OFF-LINE ANALYSIS PLAN FOR THE 2002 PIXEL TESTS

DATA PROJECTION

Based on the run plan outlined on page 19, we expect at most a few hundred gigabytes of data total which will be archived to disk and tape library for analysis.

Anticipated data sample:

Total number of triggers on tape	less than 10^8 (1 track/event)
Size of data sample	less than 250 Gbytes
Number of 5 GB 8mm tape equivalents	less than 50

ANALYSIS PLAN

All analysis at Fermilab will be done on FNALU under normal priority, the EPP department cluster FNPPD, the BTeV LINUX cluster, and desktops and the substantial facilities available at several of the collaborating institutions. Analysis computing will not be a problem.

(i) Raw data processing:

Reconstruction time per event	negligible (single track)
Total computing power needed	negligible

(ii) Physics analysis:

Total number of events	100 million
Analysis time per event	tiny
	Total computing power is at the level of a few workstations

(ii) Monte Carlo studies:

Total requirements are at the levels of a few tens of hours on a workstation system.

REQUEST

While our CPU requests can be handled from Fermilab general resources and university resources, we would like to have about 100 Gbytes of disk and about 200 Gbytes of storage in the Enstore system to be able to conveniently access key raw and derived datasets.

COMPUTING DIVISION ANALYSIS MODEL

The analysis of the data from these tests will be carried out on Fermilab general purpose computing facilities, on the machines in the EPP cluster, and on computing at collaborating institutions. Given the scale of this activity, no additional formal plan is required at this time. The experimenters will inform the Computing Division if it appears that the scale of the computing will increase significantly from what was stated above.

APPENDIX III - E918 BTEV PIXEL TEST BEAM 2002-3 RUN PLAN

Assumptions:

16-weeks of running
84 hours/week of useful data (i.e. accelerator, beam line and experiment downtime is 50%)

Let t_0 be the start date of the 2002-3 Main Injector fixed target program.

t_0 - 6 months	begin assembling DA and pixel telescope
t_0 - 4 months	begin work on trigger counters and design of stands
t_0- 4 months	begin to establish presence in MTest , establish necessary infrastructure, and determine final layout of apparatus, cable runs, etc.
t_0 - 1 month	complete installation of trigger system, electronics, beam-tracking pixel telescope, and DA in MTest
t_0	Begin to commission beam and apparatus
t_0 + 2 weeks	start investigation of properties of devices under test

Run Plans:

1. Goals:
   The primary goals are to measure the efficiency, charge sharing, and resolution as a function of the irradiation previously accumulated on devices, under various conditions of incident angle of the track, threshold setting, and bias voltage of the sensors with readout chips from various vendors.
2. Run plan:
   a. We will need two weeks for the installation and alignment of the beam-tracking pixel telescope and the pixel test devices. This can be done well before beam. We plan to have the essentials in place and ready by June 15.
   b. We will need two weeks of beam time to set up the trigger, tracking telescope, and the pixel detectors under test.
   c. We will need up to 4 weeks for data taking for each device under test.
3. Additional considerations: We would like to study the resolution of the detectors operated at a variety of temperatures, including cryogenic operation using LN2.
4. Repetition of above items 2b and 2c as additional irradiated detectors and cryogenic become available.

APPENDIX V - E918 BTeV Pixel Tests Hazard Identification Checklist

Items for which there is anticipated need have been checked

Cryogenics	
	Beam line magnets
	Analysis magnets
X	Target (Si pixel detector under test)
	Bubble chamber

Pressure Vessels	
	inside diameter
	operating pressure
	window material
	window thickness

Vacuum Vessels	
	inside diameter
	operating pressure
	window material
	window thickness

Lasers	
	Permanent installation
	Temporary installation
	Calibration
	Alignment
type:	Nitrogen
Wattage:	
class:	III

Electrical Equipment	
	Cryo/Electrical devices
	capacitor banks
	high voltage (> 5 kV)
X	exposed equipment over 50 V

Flammable Gasses or Liquids	
type:	
flow rate:	
capacity:	

Radioactive Sources	
	permanent installation
X	temporary use
type:	Fe55, Sr90,Ru
strength:	

Hazardous Chemicals	
	Cyanide plating materials
	Scintillation Oil
	PCBs
	Methane
	TMAE
	TEA
	photographic developers
	Other: Freon 14

Hazardous/Toxic Materials	
	List hazardous/toxic materials planned for use in a beam line or experimental enclosure:

Target Materials	
	Beryllium (Be)
	Lithium (Li)
	Mercury (Hg)
	Lead (Pb)
	Tungsten (W)
	Uranium (U)
	Other : Probably C/Al/Cu/Si

Mechanical Structures	
	lifting devices
	motion controllers
	scaffolding/elevated platforms
	Others